Patent Disclosure for
Home Network, browser based, command and control:
CLO-HTML/HTTP/IP/IEEE1394.

Enabling DTV to render GUI's from and control CE devices with Command Language Optional (CLO).

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1.0   Background

A couple of goals: 1) Stretch the standard use of HTML to its absolute limits prior to making extensions to that standard. 2) Put as few constraints on the target systems as possible. There are instances where dictating behavior is required, but outside of this, dictating behavior shall be limited as much as possible.

The heart of the "power of the web" is made up of two primary things: 1) Hyperlinking gives us the ability to get from anywhere to anywhere with one simple "reference" click. 2) Servers (and authors) are able to present new information, a new user interface, and many custom features to the masses who have web browsers as long as they stay inside the HTML spec boundries. This is a simple statement, but a very powerful notion. Historically, users have had to get "new" software on their computers in order to have these new "experiences". Never has there been a spec which is both simple and flexible which allows the world to choose one web browser piece of software to experience so much diverse material. Also, with the advent of server-side custom components, the user can be presented with simple HTML which activates complex server-side actions without the user knowing "what's behind the curtain".

A key in understanding why these points are so important is to realize that this means each device is almost completelyresponsibile for its own actions and this makes it almost fully independent of all other devices. This is really the idea of"encapsulation".

As long as each device on the network has HTML files to describe their GUI and as long as they use HTTP protocol to transfer those files, then any "client" device that understands how to "web-browse" and render HTML will be able to use the device with the human-interface GUI. There are caveats to this such as automation and macro capabilities which do complicate things, but the power of the web does indeed lend itself very well to the home theater for such devices. The reason this works is that if a new "unknown" device is invented with a new function such as "instant video rental", all the new device has to do is present the HTML code which implements a button whose label is "Instant Video Rental" and when the user presses this button, the action taken is to "submit" or "post" information back to the originating

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device. The device itself figures out which button was pressed and takes the appropriate action to carry out the action. The client system has no knowledge of how this happens and does not need to know (nor does it want to).

2.0   Outline

The Home Theater is considered to be the model for digital equipment throughout the whole home, see figure 1. This shows a collection of entertainment sources, audio, video and data networked together by a digital home network and one or more Digital TV[1] sink or display devices. The DTV provides the human interface for the whole system via GUI and the display.

There cannot be only one network to satisfy all needs and so the diagram shows bridges to a Home Automation network and a 1394 network that supports IEC1883 protocols. Another example (not shown) is an Ethernet Home Office Network. One of the reasons for choosing IP protocols is that it is a fully mature routeable inter-networking protocol that allows different networks in and outside the home to inter-operate.

See Home-Network Protocol Proxy Appendix.

The problem faced by the DTV designer is how to control the potential myriad of devices while keeping the unit simple, current and generic.

The brute-force way is to build a DTV with knowledge of all the devices and GUI user interfaces for them. In addition one could develop a command set for the digital interface to enable remote control. One problem with this approach is that given the development rate of new devices it is impossible to keep the DTV GUI and Interface/Network command set from being complex and obsoleted.

The approach chosen here is for the DTV to be a rendering Browser and bring in the Character of the device the user wishes to control, see figure 2. The device is represented by an 'html' (hyper text mark-up language) file kept in a accessible directory of the device. The 'html' file is an ascii text file with details of the device and infomation that enables a browser to present it graphically.
In addition to 'bringing in' the html GUI to the DTV there is a return capability back to the device making the mechanism 2 way. The user can view the rendered html GUI and control the device by 'clicking' buttons and form fill.

The DTV browser accesses, using http protocol, the devices html file and renders it to create the devices GUI and present it to the user. The DTV can do this for any device but doesn't know what the

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1.See appendix for definition of DTV

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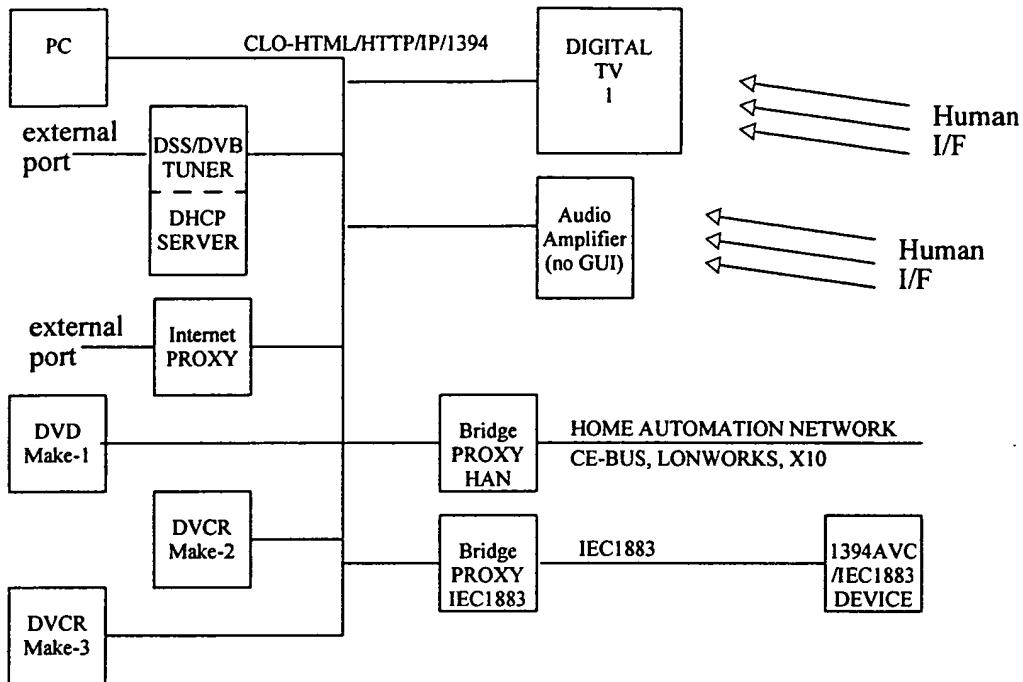
Figure 1, HOME THEATER

device type is -it is up to the human intelligence to read the GUI. This mechanism is used ordinarily for accessing information by computers communicating on the Internet and World-Wide-Web (www). In the case here, for device control, the html file represents the character of the device whereas in the www case the html file represents information.

The device behaves like a server and the DTV behaves like a client. The client accesses the server initially to control it and later perhaps to receive it's video program stream. Typically the server has multiple html files in a file directory structure. In this case they may be partly device specific html and partly dynamically generated html from the media installed or online. The user is unaware of the physical source of the html GUI's eg some reside local to the DTV for it's own control to enable the switch between the overlay or window for the control browser and the overlay or window for the video program on the DTV.

For simple cases the DTV is completely generic and there is no need for an interface command set. Moreover the system is compatible with the Internet protocols so may be controlled from a computer outside the home running a browser just as well as the home DTV.

As with the Internet case, the html file access use the http protocol that runs on the TCP transport protocol and IP network layer protocol. TCP provide a reliable delivery mechanism and IP the routeable addressing mechanism. The data transfers of audio and video program material are started by the html mechanism but run on the digital interface using hardware streams outside of the client server http/IP network based system.

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DEVICE

DIGITAL TV

CHARACTER IN DEVICE .HTML FILE — HTML FILE → BROWSER RENDERS GUI FROM HTML → DISPLAY TO USER → **USER**

CAUSES HARD-WARE ACTION ← RESPONSE ← CLICK / FORM FILL-CAUSES RETURN ACTION ← BUTTON 'CLICK' ON CHOICE
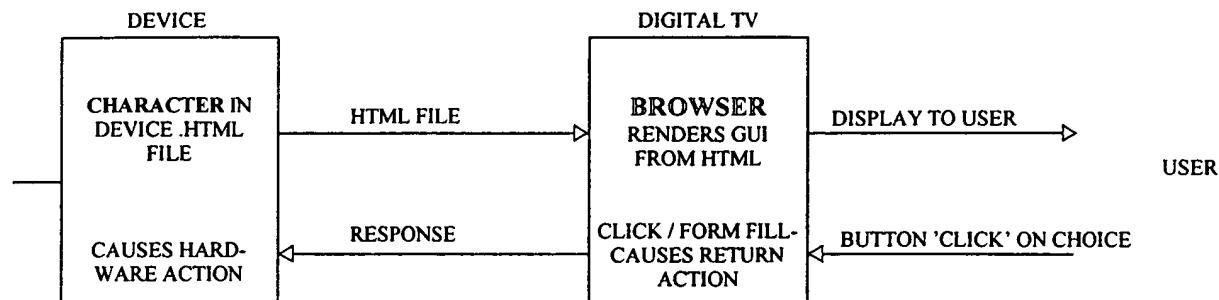
Figure 2, HTML 2 Way Mechanism

There are 2 cases where the html GUI command and control method isn't sufficient:-
2) Machine and/or automatic control (see later).
1) A client with no display capability (no GUI) -illustrated by the Audio Amplifier device. This is considered to be a low order problem as there are other ways to get-around this problem.

For these cases it is appropriate to have commands, buried in the html code, that are readable and writeable by software see later.

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3.0　　　Architecture

3.1　　　Model

For simplicity the architecture is described with 3 devices: DTV (Digital TV), DVCR (Digital Video Cassette Recorder) and DSS-NIU (DirecTV Satellite System-Network Interface Unit), see figure 3.

The DTV is a Client as described above (client DTV unit also has to have server capability to enable access to the local hardware, see later). See appendix for more detail on the client model.

The DSS-NIU is a mini-server (limited capacity) unit that can output a video program. The DSS-NIU is the video program tuner (satellite) separated into it's own unit called Network Interface Unit. Logically this makes sense as both DVCR and DTV can now make use of the NIU capability. See appendix for more detail on the mini-server models.

The DVCR is a mini-server unit as regards control. When recording (from DSS) the DVCR receives data and seems to be a client but this is a data transfer outside of the realm of client/server model.

external
port

```
DSS-SERVER
+
DHCP and
NAME SERVER

DVCR-SERVER

DTV-CLIENT
BROWSER

Human
I/F
```
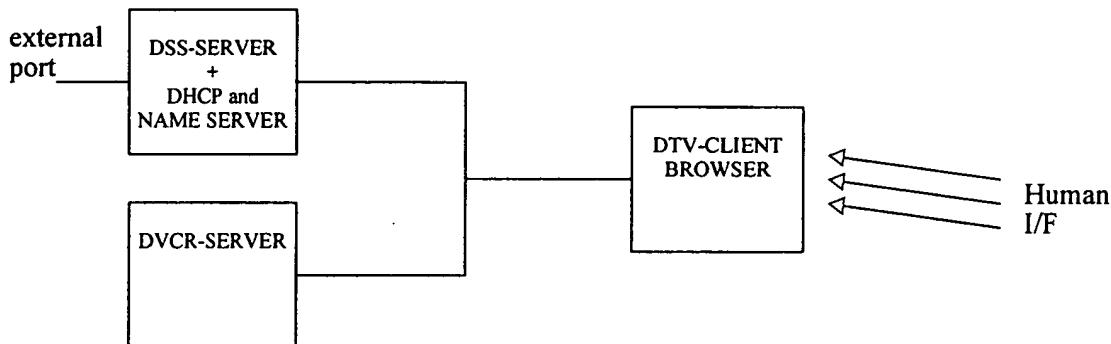
Figure 3, Architecture Devices

3.2　　　Device and Media discovery

The IP network protocol has to be automatically supported by the system. The unit least likely to be replicated is nominated to be the DHCP server (Dynamic Host Configuration Protocol) -in this system the DSS Server (though can be installed in any device of the home network). This is required in IPV4 (IP

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network protocol version 4) to enable the network to work automatically and not require fixed IP addresses to be set up by the user. With future IPV6 this requirement will go away.

See also appendix : Self Populating HTTP Server.

As the DTV and DVCR power up they run DHCP client software that broadcasts on the network for the DHCP server. Once the DHCP server assigns IP addresses and names it updates the DSS-PC resident, *devices.html* file with a hot link to each of the devices top-level html page.. This becomes the key file for user on the network to access devices, see figure 4. (ALL FILE NAMES GIVEN ARE ABRITRARY UNLESS OTHERWISE STATED).

|		
LOGO (SAMSUNG)	ICON (DVCR)	
LOGO (SONY)	ICON (DVDP)	SELECT FROM BUTTONS TO LEFT
LOGO (NEC)	ICON (PC)	
	ICON (MEDIA)	
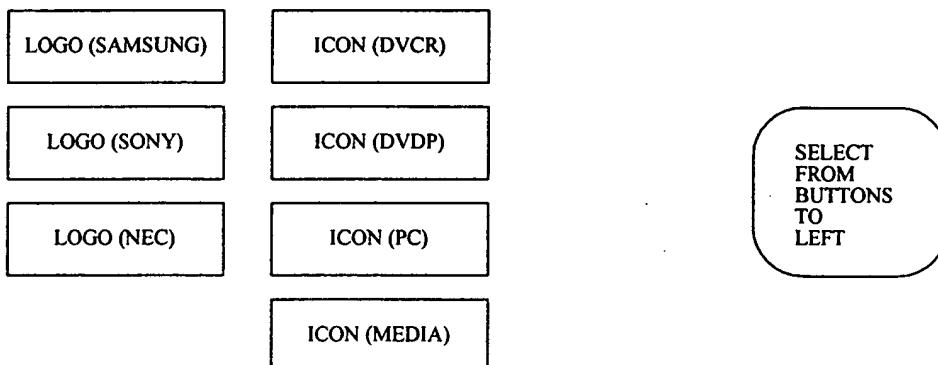
Figure 4, Devices GUI -html

When the DTV powers up the browser runs and displays the DTV top-level default html page which is the local user GUI *file:///C/dtv/user.html*. This file is like the front panel control or remote control of the TV. One of the buttons is "devices on home network". This accesses the URL *http://dhcp_server.xxx/devices.html* (the actual access hot link would not specify the filename.html and would therfore access the machine_name/default.html). This must be a standard URL (hot link) for the home network the details of which (IP address and machine name) are completed by DHCP(client). For the case of the NIU, one physical unit which incorporates the DHCP server and DSS-NIU, there are 2 separate default files accessed by different IP addresses ie machine names.

There is a case for obtaining a standard, top-level-domain 'dot extention' (machine.xxx) from InterNIC for the home network to clearly identify all local hot links and save unnecessary external internet access.

The devices.html file accessed contains entries (buttons) for all available devices in the system. In this model it contains 3 entries (dtv, dvcr and dss). The user can now access all the devices, see devices.html GUI figure 4.

A devices *user.html* GUI contains access to a structure of html files for additional purposes eg set-up of device (adjusting brightness levels etc); selecting program material (TV channel); making a profile or

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macro; checking status; automatic control etc, see figure 5.

LOGO (SAMSUNG DVCR)		

| | ICON (BRIGHTNESS, VOL- UME CONTROL ETC) | |

| | ICON (FAVORITE PRO- GRAM CHANNELS) | SELECT FROM BUTTONS TO LEFT |

| | ICON (MAKE PROFILE OR MACRO) | |

| | ICON (BACK) | |
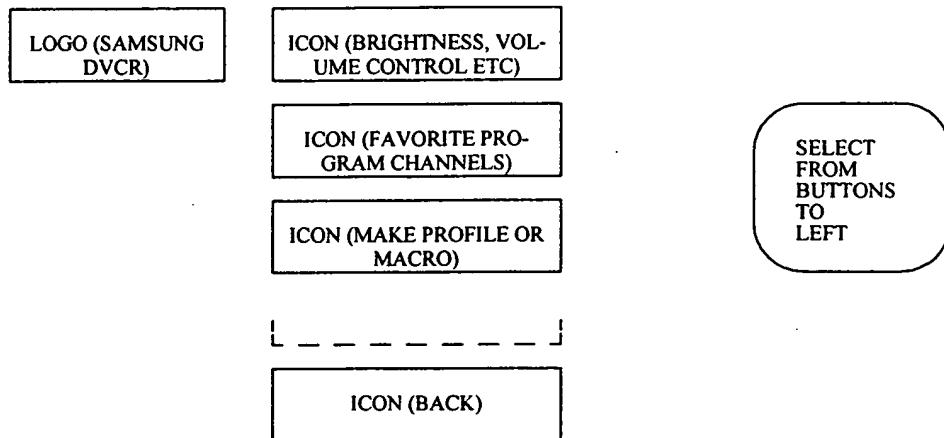
Figure 5, DVCR example User GUI -html

These human driven control actions take place entirely at the device using the GUI also from the device so an industry standardised command and control set isn't necessary. However, standard ascii command set descriptors can be useful for scenarios involving machine driven (automatic) control.

Note the use of LOGO and ICON graphic (GIF) files. These allow the graphical company logo and icon device descriptor to be used. The GIF file names, sizes and compression type can be standardised to:- *logo.gif, size: 120x40* and *icon.gif, size: 120x90.*

GIF compression is chosen because it is lossless, easy to render, and supports transparency and animation (against is the limit of 256 colors).

3.2.1 Device Page

The Device page will list all of the devices on the Home Network with a link to each of the devices' top level HTML pages. The icon and logo image files will all be of a standard size so the list will can be arranged in an orderly manner. Preferably the device's logo would be displayed directly above the device's icon. The logo can act as a link to the device manufacturer's home page if so desired and the icon will be a link to the devce's top level HTML page. The images can be arranged in any manner desired by the NIU Server manufacturer, from as simple as a row and column configuration to a network topology diagram if possible. The NIU Server manufacturer might even allow the user to rearrange the images as they see fit and provide them with an additional text line below each device where the user can enter their own name or description for each device. For instance the user might be allowed to group devices by their location in the home with a name for each location (this kind of feature is entirely implementor driven and is not required).

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3.2.2   Logo Image Files

A Logo image file is a file containing an image that represents the manufacturer of the device. It would typically contain an image with the name and logo of the manufacturer of the device. In order for the NIU Server to locate the file it must use the name *icon.gif*. The file must also be of a standard size, 120 x 40 pixels, so the list of devices will have a neat, uniform look. Several variations of the logo file may reside on a device with a link to the desired file. The link can be updated over time or based on certain criteria of the manufacturer's choosing. The image may also be animated.

3.2.3   Icon Image Files

An Icon image file is a file containing an image that represents the type of device and potentially its state. It would typically contain an image with a picture of the device or a symbol that represents the type of device. In addition, a model number might be included at the bottom of the image to assist in identification of the device on the Home Network. Several variations of the Icon file may reside on the device with each one representing a potential state. A link to one of the images would represent the current state of the device. To represent the various device states, the manufacturer has the choice of using a variety of symbols, colors, or even animation. (List some graphical examples below). The link may be updated over time or based on certain criteria of the manufacturer's choosing to indicate a change in state. Possible state values may be On, Off, Playing, Stopped, Recording, Rewinding, Forwarding, Searching, Media Inserted, or Media Absent.

The purpose of the Icon image is to provide immediate device state information feedback to the user. In addition, since the Icon images are retrieved from all devices whenever the device list is displayed, there is an immediate indication of the accessibility of all devices on the network. In order for the NIU Server to locate the file it must use the name *logo.gif*. The image must also be of a standard size, 120 x 90 pixels, so the list of devices will have a neat, uniform look. Note that it is up to the device to decide which of it's many ICON's to substitute when asked for *icon.gif*.

3.2.4   Location of files after discovery phase

Figure 6 is a summary showing the location of files after the device discovery phase. Here each device now has a *user.html* file and the DHCP/Name Server has the *devices.html*. In an actual implementation these would both be named *default.html*.

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Witness Name................................. Signature................................. Date.................................
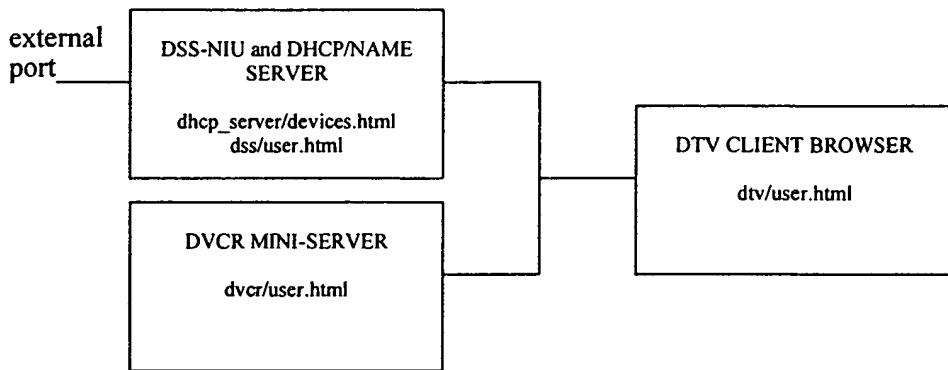
Figure 6, Files Location after Device discovery and selection

3.3   Device set-up and control actions

Use button 'clicks' and form fills to run programs and scripts on the device to make control actions. This is local and proprietary to the device -not performed remotely and therefore doesn't require any standardised 1394 command set. See figure 7 for location of the file and program components.
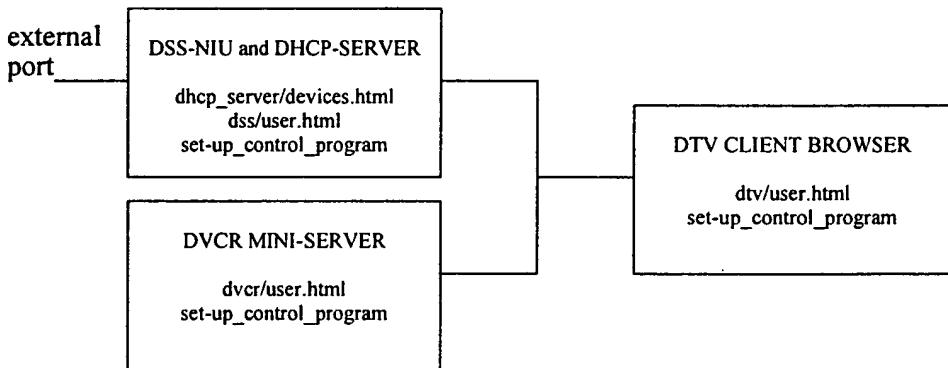
Figure 7, Files/Programs Location after Device set-up and control program

An example is given. The user may wish to change the brightness. On the User html GUI page the user can click on the brightness button. This may bring up another GUI with bright and dim buttons. If the

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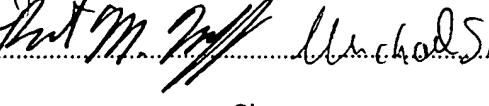
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Witness Name............................   Signature...........................   Date..............................

user clicks one of these the http server will cause a set brightness control program to run and make the control hardware action. For action local to the DTV the DTV needs server capability -something to interpret the post actions from the browser.

All home network DTV devices need server capability to be able to post actions to control their local hardware. This is important to understand. You can have a browser to pick up local html files and render them to a GUI but this doesn't invoke the http server. Clicking on a button must involve an http access to the local machine name or IP address to invoke the local http server to respond which in turn invokes the local device (eg brightness) control program.

3.4   Program selection

Here additional html files are available to represent the programs audio and video material available for the server device to source. They may be represented directly on the user GUI or down a level. They are represented as *dss-channel.html* and *videofile.html* for the dss-niu and dvcr respectively. These html files are special as they are not at all static. The device updates the html file based on the dss EPG (Electronic Program Guide) and in the case of the dvcr the tape present in the machine. A program must exist as a go-between the source material content and the html file GUI available to the user. This is called the Dynamic Content_Control_Program. See figure 8 for the location of files and programs.

3.5   Making a Profile or macro

In order to reduce several, often used steps to a few easy steps, the use of macros as shortcuts is beneficial. Macro's are also used to store user Profiles or preferences. A macro is a sequence of commands that is saved in memory and is easily retrieved and executed at will. A macro is created by saving the commands that would normally be executed during a sequence of button pushes or actions by a user within the user interface. The macro is given a name so that it may be easily retrieved at a later time and executed. When the macro is executed it executes the sequence of actions in the macro just as if the user were selecting buttons or performing actions from within the user interface.

A macro is made and stored on the Server for which it is created. Because of the difficulties overcoming possible conflicts and deadlocks with other devices, a macro's scope is limited to the Server on which it is created. That is, it can only execute actions that pertain to the Server on which it was created. Therefore, when a macro is created it must be limited to commands that pertain only to the Server. Profiles/ macros across multiple machines are to be tackled at a later time.

If the macro feature exists then the *user.html* contains a profile/macro button for generation on the server. Clicking this button starts the profile or macro recording by the macro generation program.The macro generation program monitors and saves all subsequent hotlinks accessed ('html issues') and 'return actions' for later replay. Ultimately the program results in the creation of another button the named profile or macro with hot-link: *cgi_bin/macro_for_user.html.*.

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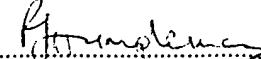
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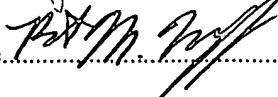
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For more detail on macro generation see apendix.

3.6   Checking status

After a client (html fetch) and server (return-action) handshake the http spec server normally returns a status response code to indicate return-action good or not good (eg 200 returned indicates good and 400 or 300 returned indicates no-good). A bad response initiates a fetch of the *status.html* GUI this can include *icon.gif* files that indicate graphically what the problem is. See figure 8 for the location of files and programs.Subsequently there can be a 'follow-up' action to access STATUS.HTML files generated and resident on the server with further information and suggested corrective action, see figure 9.

external
port

```
DSS-NIU and DHCP-SERVER

    dhcp_server/devices.html
          dss/user.html
     set-up_control_program
    content_control_program
  material/dss-channels.html
          status.html
```

```
DTV CLIENT BROWSER

       dtv/user.html
  set-up_control_program
       status.html
```

```
DVCR MINI-SERVER

       dvcr/user.html
  set-up_control_program
  content_control_program
   material/videofile.html
       status.html
```
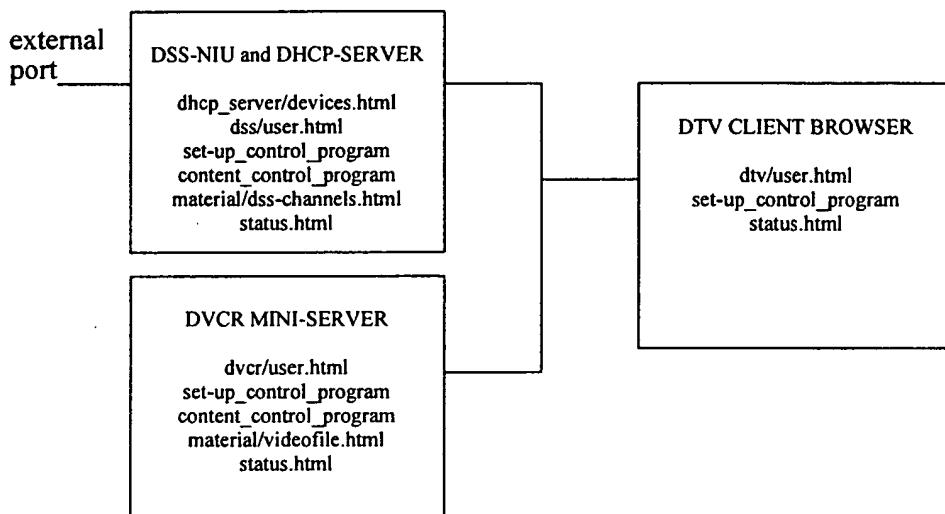
Figure 8, Files/Programs Location after Program selection and status

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DEVICE   DIGITAL TV

DEVICE		DIGITAL TV	
ACCESSDEVICE .HTML FILE	HTML FILE →	BROWSER RENDERS GUI FROM HTML	DISPLAY TO USER → USER
CAUSE ACTION RETURN HTMLSTATUS CODE	← RESPONSE	RETURN ACTION	← BUTTON 'CLICK' ON CHOICE
	HTML STATUS →	DISPLAY GO/NOGO STATUS	STATUS 'CODE' TO USER → USER
			FOLLOW-UP
ACCESS STATUS_INFO .HTML FILE	← RESPONSE	SEND REQUEST STATUS_INFO.HTM	← USER 'CLICK' STATUS INFO
	HTML FILE →	RENDER STATUS.HTML GUI	STATUS.HTML TO USER → USER
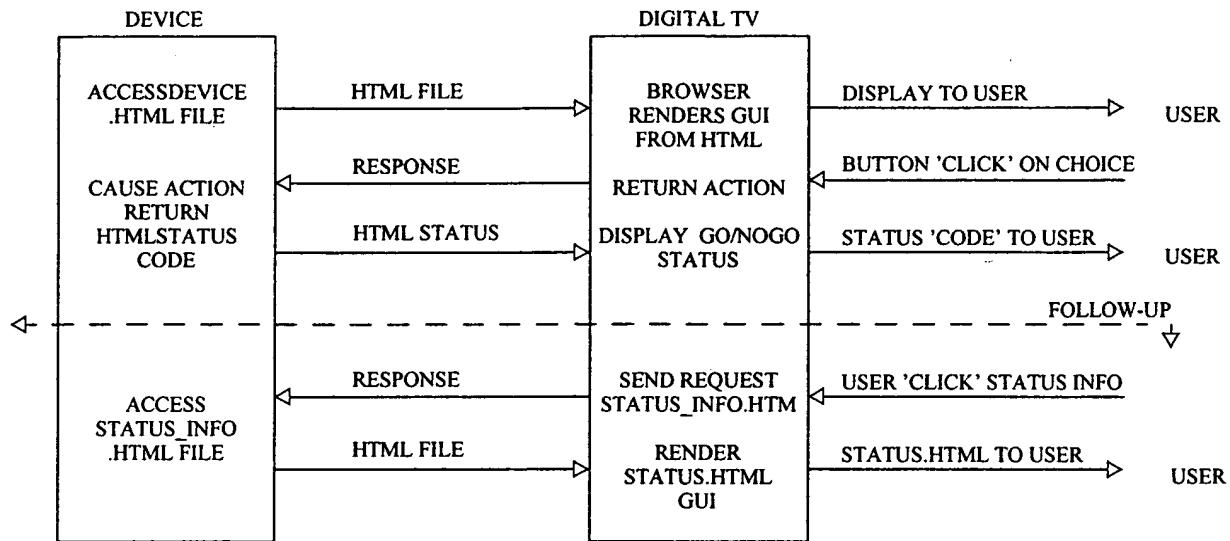
Figure 9, Status code response and Follow-up status access

3.6.1   Follow-Up status checking

One of the inherent challenges associated with a digital network attached to consumer devices is the problem of multiple near-simultaneous access effecting the device. An example of this is that one NIU device could be setting the VCR's clock while someone at a DTV is telling the VCR to play a video while someone at a PC (at work possibly) is telling the VCR to "record channel 7 at 8pm tonight for 1 hour". Each of these activities has a status associated with the action. In the case of "atomic" operations, the status returned is either OK or NOT OK and that is all. In other operations such as rewinding a tape, the initial status may come back as "OK", but a status regarding how far along the rewind is or just if it has completed rewinding is needed via a status page. Another non-atomic example is a more complex one where the VCR has been set to record later tonight, but the user (now at work) wishes to change that setting or delete it alto-gether. This section describes an innovative way to handle these types of situations through multiple "status pages".

When a client makes a connection to an http device, the client's IP address is given to the device so that the device knows where to send the requested information (HTML files usually). The idea here is to use that IP address as a unique identifier for making custom status files on the device for each client. So, in the above example, there would be three custom status files for "status.NIU_IPaddress.htm", "sta-tus.VCR_IPaddress.htm", and "status.DTV_IPaddress.htm". This gives each of those clients the ability to get status from the device which pertains ONLY to their client and no others. A generic "status.htm" file would contain hotlinks to each of the custom status pages as well as some other general status about the

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device (no tape inserted, 3 record_times currently set, low battery (if appropriate), power reset 20 minutes ago, etc.) So, to be clear though, remember that each device has an actual IP address such as 192.3.27.14 and so making it unique.

3.7 CLO-on-HTML/HTTP/IP/1394

(CLO -Optional Command Language)
An industry standard command set on top of html is useful for Automation and to a lesser extent GUI-less client devices eg Audio Amplifer. This allows software to review html files for content and respond to make control actions. The command language is optional. Home devices and Digital TV work just fine with HTML/HTTP/IP/1394.

A front-panel button press on the Audio Amplifier (involving an external device) is used for GUI control even though no GUI is displayed. Here the external device html is accessed and a parser reviews the html and select keywords. A control program selects the response return depending on the function required.

Hot-links are standardised as commands eg source_select.html, increment_volume.html, bass_level.html, treble_level.html. The device can be now operated locally or remotely and can control other devices.

3.7.1 Automatic Control (eg One touch record)

Automatic control of the home network devices the layout of a set of necessary "control commands" for automation. This list, see table 1, is not an all-encompassing list of commands but an effort is made to make it as complete of a list as possible. This makes the implementors' job easier and clearer. Remember that many devices have no need to implement these commands. Only devices which have such functions or have a need to control other devices which have these functions have the need to implement specific functions from the list.

Table 1: One Touch Record

Name	# Fields	# Buttons	Description
Time_Set	1	1 (set)	hhmmss (Local time)
Record_Time	4	1 (set)	ch#, time(hhmmss), len, mode?
Record_Time_Delete	2	1 (delete)	ch#, time(hhmmss)

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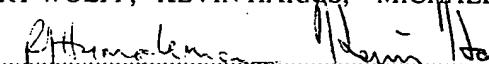
Inventor's Signature.. Date.6/16/97
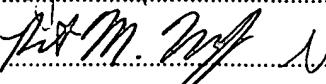
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Table 1: One Touch Record

Name	# Fields	# Buttons	Description
Mode_Select	1	1 (set)	For SP, LP, SLP modes. Should this be a drop-down instead?
Stop			
FF			
Rew			
Play			
Record			

The home network model with separate NIU, VCR and DTV requires some automatic remote control must take place across the network. Simple actions involving 2 devices eg dtv and a server are controlled by the simple html GUI mechanism described above. It is a simple action to select the dvcr GUI and play a tape installed to the dtv, however, setting the dvcr to record involves 3 devices the dss-niu, dvcr and the dtv where the control information entry takes place. One could set-up the dss-niu and then go and set-up the dvcr this would be 2 simple actions. However it is thought that the user would want an automatic one touch record system available.

One touch record takesplace at the dss GUI where a selection is made for a future recording. Somehow the information must be transfered to the dvcr automatically. This is done by the dss server accessing the dvcr GUI automatically and filling in the record information and returning it back to the dvcr.

This action involves an html GUI based command-set as a program in the dss-niu server must be able to scan the dvcr GUI for recognisable key words eg "RECORD_TIME" to enable it to fill in the time. This program needs to know it is accessing the dvcr GUI. Prior to this section the dtv accesses GUI's under human control and the machine had no knowldege of the device.

The One Touch Record (OTR) program is triggered by the server observing a 'record_program' set in the dss GUI. The OTR accesses the dvcr GUI transfers information from the dss GUI to the dvcr GUI and returns the dvcr form to set it to record, see figure 10.

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```
external        ┌────────────────────────┐
port            │  DSS-NIU and DHCP-SERVER │
────────────────│                          │        ┌─────────────────────────┐
                │  dhcp_server/devices.html│        │   DTV CLIENT BROWSER     │
                │      dss/user.html       │        │                          │
                │   set-up_control_program │        │     dtv/user.html        │
                │  content_control_program │────────│  set-up_control_program  │
                │ material/dss-channels.html│        │      status.html         │
                │       status.html        │        │                          │
                │       otr program        │        │                          │
                └────────────────────────┘         └─────────────────────────┘
                ┌────────────────────────┐
                │    DVCR MINI-SERVER     │
                │                          │
                │     dvcr/user.html       │
                │  set-up_control_program  │
                │ content_control_program  │
                │  material/videofile.html │
                │      status.html         │
                └────────────────────────┘
```
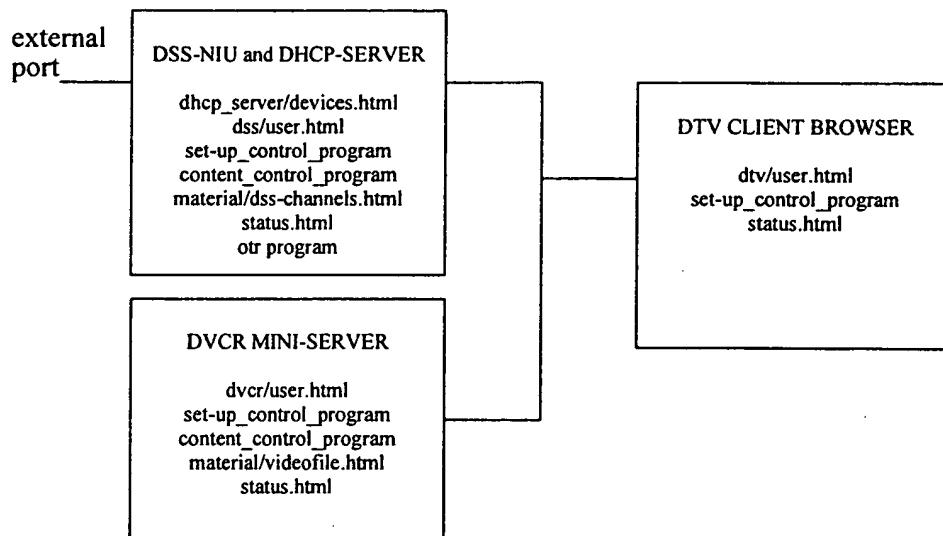
Figure 10, Files/Programs Location with OTR program

3.7.1.1   One Touch Record -How it works

See appendix.

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4.0 Conclusions

The industry is currently looking a number of approaches to solving the home-network/Digital TV Interface problem.

4.1 Approaches

All approaches use IEC1883 for transport of isochronous data streams across IEEE1394 or special hardware control of 1394 isochronous streams for non-MPEG2 transport. There are 3 different approaches to controlling the program material streams as outlined below.

4.1.1 Hardware-level command and control (1349AVC/IEC1883/IEEE1394)

This approach without network layer addressing (eg IP) is limited in scope to local cluster control and data flow. The system is fixed to 1394 physical layer and a detailed hardware level command and control specification must be standardised (and is under development) for all devices to use.

Further functional and interconnect expansion can be done with proxy devices converting from network/application layer command and control to the AVC/1883 type command and control.

The approach doesn't work well for a Home Theater DTV which is expected to control everything. A complex GUI would have to be accompanied by the detailed command set for every device making it difficult to design, expensive and quickly obselete.

4.1.2 CAL/IP/IEEE1394

This approach uses the command language CAL on the network layer IP so is much more general and flexible than 3.1.1 and not restricted just to 1394.

The method seems not to solve the problem of DTV GUI availability for all current devices and obelescence regarding future devices and relies on remote control over the network layer IP.

4.1.3 CLO-html/http/ip/1394 (SIPHOT approach)

HTML/HTTP neatly solves the GUI problem by making the DTV a rendering browser and no interface command set is needed for human control of home network devices. An Optional Command Language (CLO) can be used for automatic machine control of devices (rather than human control). This takes the form of specific ascii commands on HTML/HTTP.

One device is nominated to have knowledge of the home network devices to which all devices go initially for device or service selection.

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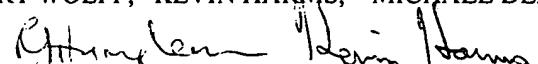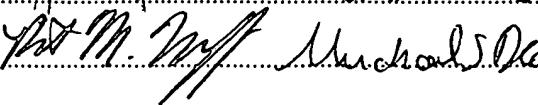
5.0 Appendix

5.1 DIGITAL TV (DTV) definition

The Digital TV (DTV) is an display device (eg like a television CRT) and a box of electronics (STE -Set-top-electronics) containing the home network interface unit (NIU) eg IEEE 1394 digital interface, Digital video/audio decompression, D>A conversion, microprocessor controller to run control software, HTTP/IP protocol, browser software etc, see figure 11.

IEEE1394 → **BOX OF ELECTRONICS (STE)** → ANALOG → **DISPLAY DEVICE (eg CRT)**
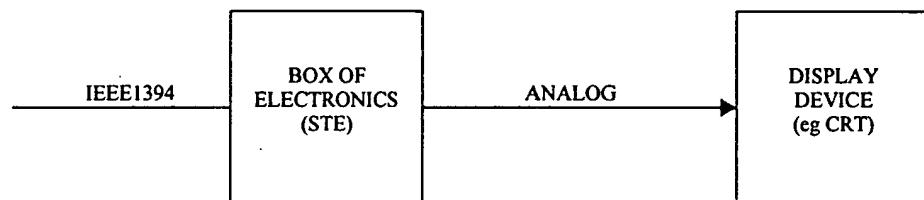
Figure 11, DTV definition

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5.2　ONE TOUCH RECORD (how it works)

The way this automation works is through the use of HTML forms and the ability for systems to automatically "simulate" user-input of values into form fields and the clicking of a "set" button. An example would be helpful here. Let us take the example of setting a VCR to record a program from 8pm-9pm on Friday night June 6, 1997 on channel 7. In the "normal" HTML GUI, the VCR would produce HTML code which would allow the user to put this information into the form and then click on a button to set this program. A very simple non-graphical version of this GUI would look something like table 2.

Table 2: VCR AUTOMATIC RECORDING SET-UP

	Please fill out forms and click on set
CHANNEL	
DATE (mm/dd/yy)	
START TIME (hhmm)	
START AM/PM	
	SET

This basic form gives all the information necessary to set the VCR to record Friday night. HTTP protocol makes our automated process simple. If each "command" has a unique name, then we implement our automation by doing the following:

Call the "action" /command/<commandname> (in this case /command/record_time) and each field gets a standard name. Then when the automated device wishes to automatically setup a record time as above, it simply prepares the following "POST" command.

```
POST /command/record_time HTTP/1.1
Content-Type: text/plain
Content-Length: 47

channel=07&date=06/06/97&starttime=0800&ampm=pm
```

Generically stated, commands/methods are handled like this:

```
POST /command/standard_commandname HTTP/1.1
Content-Type: text/plain
```

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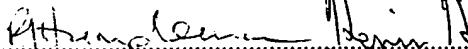
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Content-Length: calculated_argumentlength_below

object1=value&object2=value[&objectn=value....]

This simple bit of text is pushed back to the device which is to be set for recording. Then the target device responds with some status information regarding whether or not the requested record time was OK/valid or not. The status issues are dealt with in a separate section of the document. One of the interesting points to note here is that the "automatOR" device does not have to request any documents in order to program the VCR for recording tomorrow night. As long as the automatOR device knows which command they wish to invoke, they simply gather the information necessary to carry out the command (object=value arguments) and then issue the approriate http POST command and wait for an http status response back.

Indeed this does mean that we carry the initial burden of defining a fair number of commands for general use in order to cover a large percentage of the needs of the device community. This, however, is an acceptable burden as it is not too difficult to define these commands.

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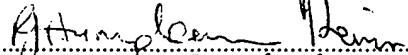
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5.3   DVCR Mini-Server Model

The DVCR-PC functions as a mini-http server, see Figures 12.
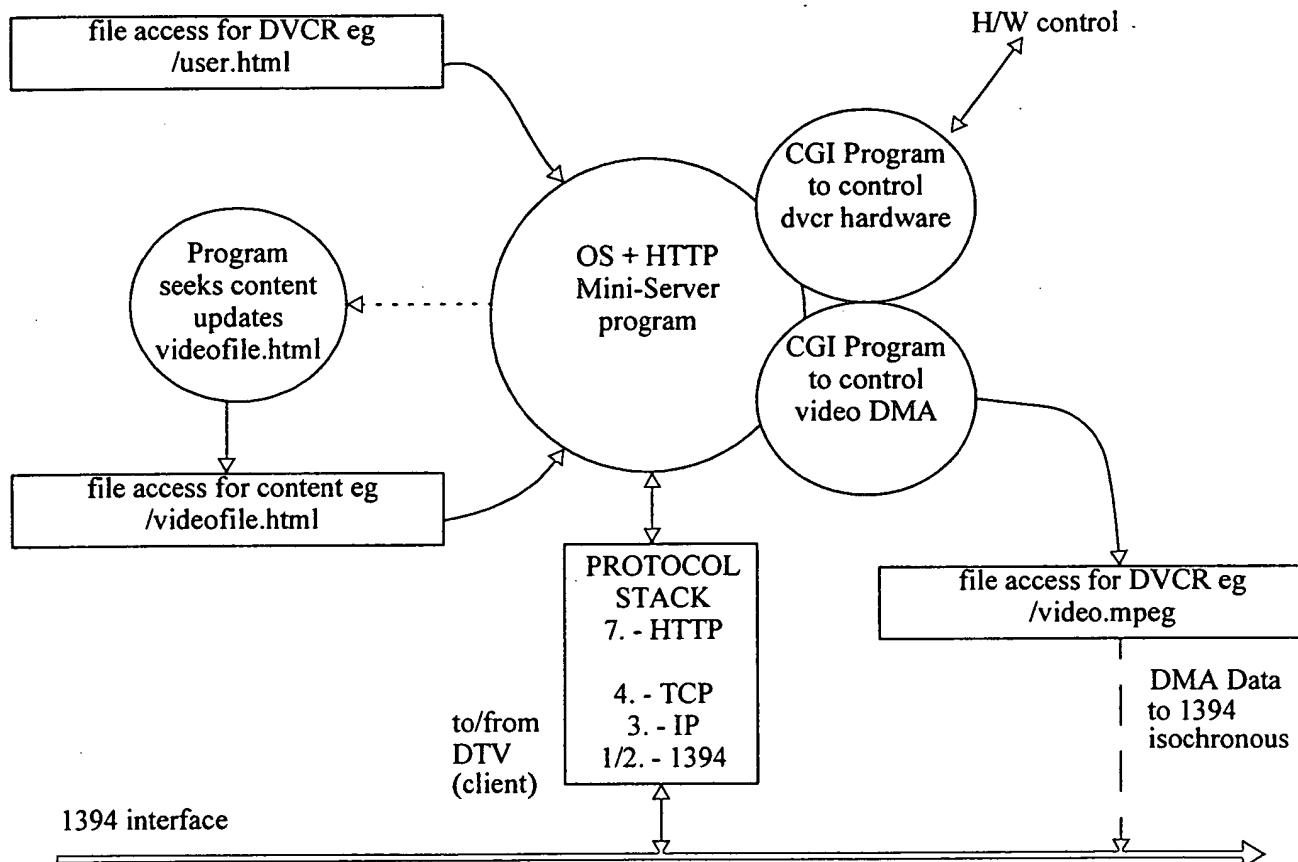

Figure 12. DVCR MINI-SERVER MODEL

5.3.1   DVCR-PC Features

PC andOS with HTTP server capability and TCP/IP PROTOCOL Stack.
HTML user GUI for Samsung DVCR (user.html) and video content on the tape/media (videofile.html)
Accessible MPEG Transport file(s)
MPEG Tpt D(DMA) output to 1394 isochronous from remote http command using CGI-BIN program
Update of content html (videofile.html) by program that can be started on command or by media insertion.

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5.4   DSS/DVB and DHCP-server Mini-server Model

The DSS-NIU functions as a mini-http server, see Figures 13. The DHCP-server is also shown here though this may reside with any unit on the network.
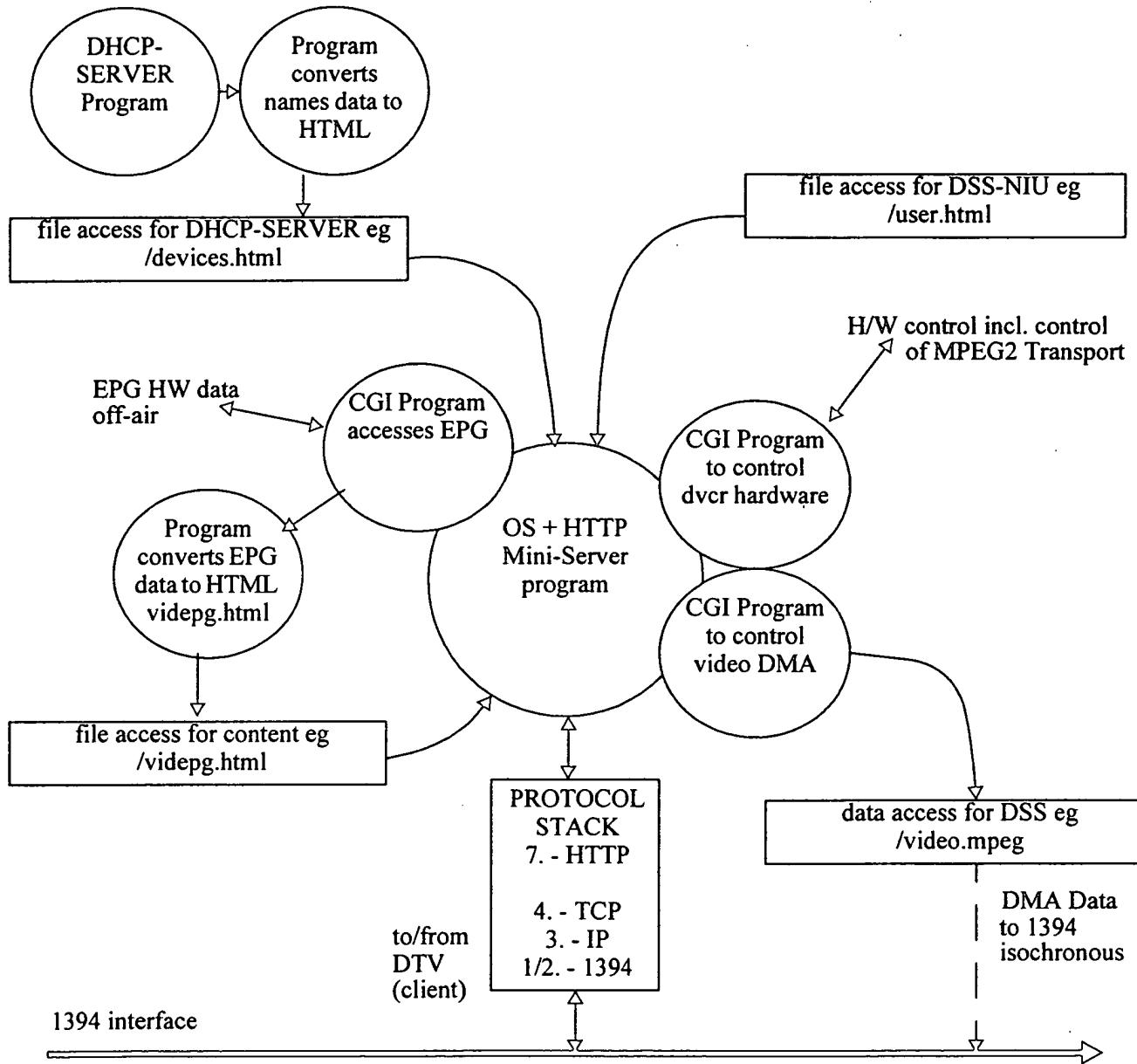

Figure 13.. DSS-NIU MINI-SERVER MODEL

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5.4.1   DSS/DVB-NIU, DHCP-Server and Internet Features

PC andOS with HTTP server capability and TCP/IP PROTOCOL Stack.
CGI-BIN program to access the hardware

CGI-BIN program to access the off-air EPG hardware and system
Program to convert accessed DSS/DVB EPG data to html GUI form.
Program to take program specific EPG data and convert to html form (eg DISNEY channels only GUI)
File access for videpg.html (video EPG data GUI)
(EPG=Electronic Program Guide).

CGI-BIN program to access the MPEG-2 transport hardware
DSS/MPEG (transport) off-air video program data output to 1394 isochronous from http command (to
MPEG2-Transport-over-1394 spec eg IEC1883) possibly using DMA.

Executables to access the DSS/DVB h/w from http command
File access for the dss/dvb-user.html -the GUI shipped with the device for device control.

5.4.1.1   For DHCP server function

DHCP (IP address discovery/assignment) Program
HTML GUI converter/generator of devices present (devices.html)
File access for devices.html

5.4.1.2   For Internet Access Function

Internet access Proxy,
Internet Firewall

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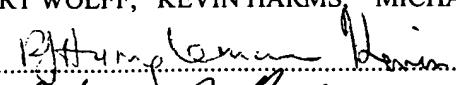
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5.5 DTV Client Model

The DTV client browser human interface is shown in Figure 14. The browser renders GUI (graphical user interfaces) but does not source them. In the demo SIPHOT the source is the Mini-Server (NIU or DVCR). The Browser has 'hot-links' that result in a new GUI and executables can be trigerred to run on the server or client.

Hot links beginning http:// access the mini-server. If the link is also to cgi-bin (or *.asp) then any executable referenced in the html script will be executed on the server. Hot links beginning 'file' are accessed on the client DTV only. Hot links to DTV(self) that are required to perform hardware action, must address the DTV server by having a bonafidi HTTP hot link to the DTV (self). This of course requires that the DTV also has HTTP server capability.

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BROWSER GRAPHIC

DSS/DVB-PLAY
http://dssplay.html

DTV
file:///c|/cgi-bin/rundtv-hw.exe/

DVCR-PLAY
http://cgi-bin/rundvcr.html/

graphics

OS

PROTOCOL
STACK

7. - HTTP
6.
5.
4. - TCP
3. - IP
2. - 1394
1. - 1394

Figure 14. CLIENT MODEL

to/from
DSS NIU

1394 interface
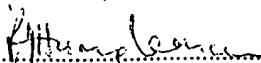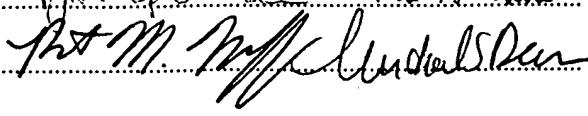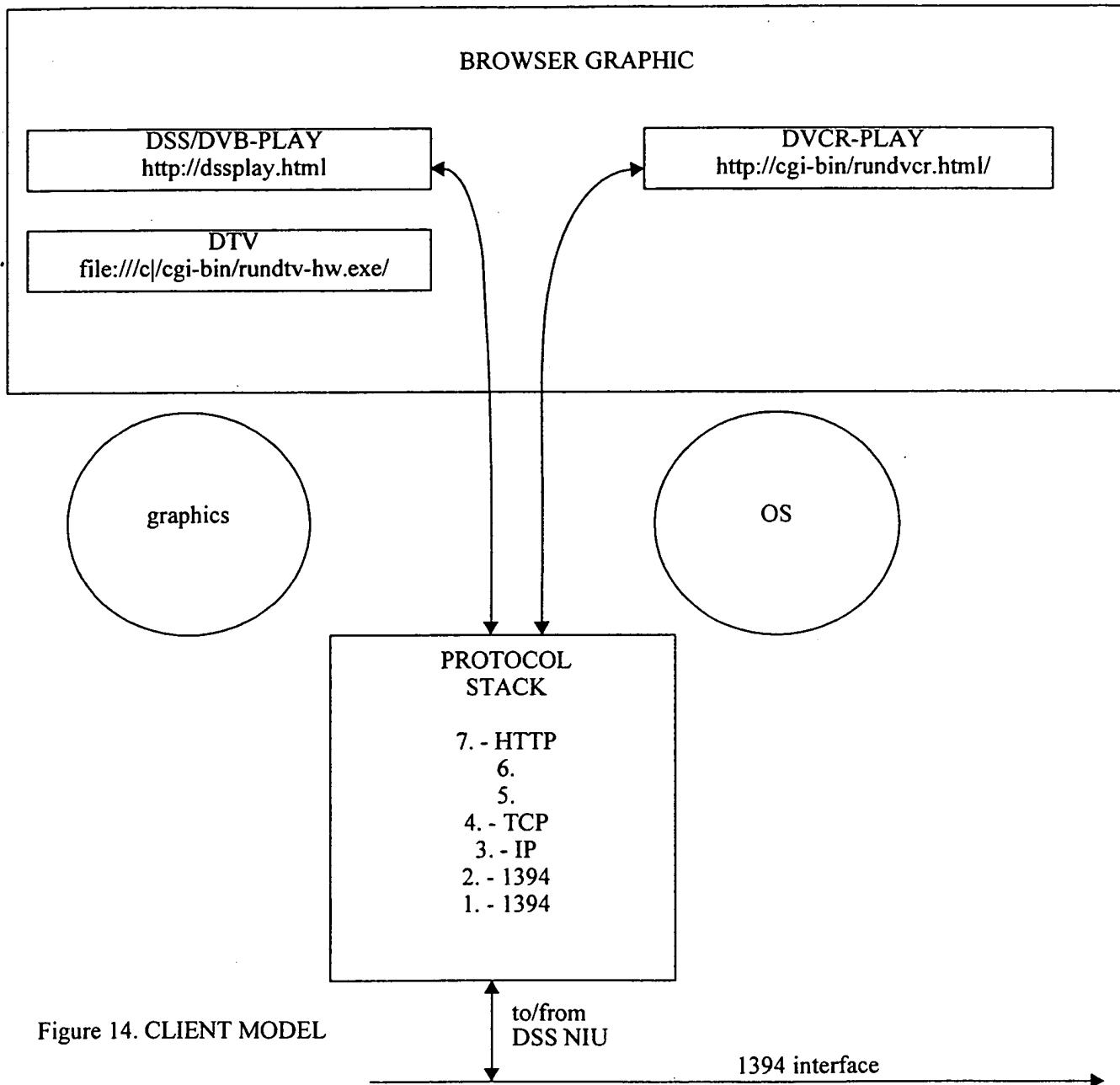
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5.6   Self Populating HTTP Server

5.6.1   Problem

From a consumer-viewpoint, all network devices should "simply work" by plugging the device into a network 'outlet' and turning the device on. It should be immediately useable etc. The desire from the user would be to have all network devices have logical names and be able to be used in a singular user interface which is both consistent and easy to use. In addition, Power-users also would like to be able to control, configure, and monitor the network in a consistent and easy-to-use fashion.

5.6.2   Solution

An HTTP server is at its roots simply a collection of files in a heirarchical storage 'tree'. Users gain access to various parts of the 'tree' by browsing through hyperlinks or by being pointed to a specific location in the tree from som external source. At the "root" of the tree, there is a general "welcome" page (home-page user interface). The branches of the tree are usually configured, created, and managed by one or more "webmasters".

In this solution, the custom-programmed webserver self-modifies its tree by creating branches for each device on the network as they are discovered and registered with the central naming authority (DHCP server). This requires cooperation between the self-modifying http server and the DHCP server. After discovering a new device, the HTTP server queries the new device for its capabilities and managability specifics. It then builds a new sub-tree-branch for this new device. Then, the "welcome" page is automatically updated with this new device information "hotlink".

At this point, the user is able to "browse" through the network of devices from one central HTTP server and is able to control, configure, and monitor them since this central HTTP server has intimate knowledge of each device on the network.

One of the more innovative pieces to this self-populating tree is that it has the ability to begin categorizing and indexing available (and unavailable) media for the home. By this, we mean that the server knows at any given time (via polling for status), which devices have which media inserted. For instance, in an advanced (expensive) home setup with multiple AV clusters, Dad puts a DVD movie in one of the DVD players in the bedroom and later that evening, he does not have to remember which DVD player it was inserted into nor if it was DVD, VCR, DVCR, etc. Using the self-populating tree, Dad finds the title he was interested in and it would play regardless of its physical location. This includes the case where Dad's son physically moves the DVD movie to another location for some unknown reason. Such a system requires devices to have insertion and removal notification to the DHCP server in order for it to keep track of which devices have what media. This indexing and categorization technique is also available to older media as well given a little "help". For instance, audio CDROM disks each have a unique ID number which can be associated in a database to the actual artist and title via a database. Even track titles, lyrics, etc. can be obtained by databases. It is our belief that with such a system (and standard) in place that the record label companies will provide the consumer with web-access to such data. This makes the 200+ CD juke-boxes much more compelling to purchase as the user gets to choose their songs to play via the television set or

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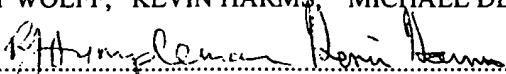
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PC.

Welcome to your Home Network
Buttons for Known devices are listed below:
TV
D-VCR
DVD
Den-Computer
Kids-Computer
DSS

Network Configuration/Testing
Network Monitoring

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Inventor's Signature..... _Rot M. Wolff_ _Michael Deacon_ ..... Date..... 6/16/97 .....

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A macro is stored on the device for which it is created. Because of the difficulties overcoming possible conflicts and deadlocks with other devices, a macro's scope must be limited to the device on which it is created. That is, it can only execute local commands. Therefore, during macro creation, only local commands can be enabled. This is a task that is left up to the developer of the macro generation routine.

5.8.3   Is Simultaneous Setup and Control Possible?

Various devices from different manufacturers may exist on a Home Network simultaneously. In order to facilitate convenient setup and control of several devices in tandem, macros may be used. When the macro is executed it executes the sequence of actions in the macro just as if the user were selecting buttons or performing actions from within the user interface. A macro is not limited to storing actions from one user interface, but can be used to store actions from a sequence of menus and various user interfaces.

In a Home Network environment the situation can be made even more complicated by a proliferation of devices that require simultaneous control and by devices that are under the control of several other devices or users (OOPS, Deadlock). (Need to resolve possible conflicts and deadlocks. Macro #1 is going to record from the DSS and gets to a point where it needs access to the VCR, but the VCR is being used by macro #2 that is recording Hawaii Five-0 from the DVD. So while macro #1 waits, macro #2 stops recording from DVD and tries to record from DSS, but macro #1 has control of the DSS.) *

For example, setting up a VCR to record from a DSS. One could leave the DSS on all the time and set the VCR to record at a particular time, but that's an awkward solution. The DSS not only consumes more power and experiences unneeded wear when left on for extended periods, but may be inadvertently switched to a different channel or innocently turned off before the VCR is able to record the desired program.

* - Any failure to acquire resources teminates the macro.

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